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DRIFTING ALGAE.

Frank S. Collins.

The conditions for collecting marine algae differ much from those for other plants. Practically all marine algae are under water part of the time, and more than half the number of species grow below low water mark; some of course can be distinguished when passing over them in a boat, but many of the most interesting species grow at a depth below the range of vision. The only way to get at these in their homes is by dredging, a slow, uncertain process. As Farlow [1] says of the dredge, "One sometimes secures by its means rare species, but as a rule, a day of dredging is a day wasted." The only way in which good results can be secured, is by a thoroughly equipped expedition, working from a steamer and going carefully over the selected area systematically. That such work may produce good results is shown by the recent Vol. XXXI of the Bulletin of the Bureau of Fisheries, containing the Survey of the Wood's Hole region. But as to the prospect of getting a fairly complete representation of the flora of a region in this way, the land botanist can judge if he imagines himself getting the flora of a meadow by going over it in an aeroplane in a dark night, with a long-handled rake.

Ever since the beginning of the study of algae, our knowledge of the sublitoral [2] flora has been obtained from the "rejectamenta," plants washed ashore; often immense quantities of algae, in great variety,

[1] Farlow, The marine algae of New England, p. 22, 1881.

[2] Sublitoral is here used in the sense of below the litoral, the litoral region including the range between tide marks; in zoological terminology it has sometimes been used as meaning partly or nearly litoral, the prefix being used in the same sense as in subtropical; I use it here in the same sense as in subterranean.

are thrown ashore on beaches after storms. That this is the normal source for material is recognized in all the text books. "Collecting on sandy or gravelly beaches is very simple. One finds there only the Florideae and larger brown sea-weeds that are washed ashore after a storm." [1] "First, from the mass of material which the sea throws up upon the beaches and leaves behind it when the tide goes out.... By careful search among this material you will find all the deep water forms." [2] "A storm is often more productive than a dredging expedition." [3] "At the time of maturity, the algae of the deeper waters are more or less readily torn away from their attachments, rise to the surface or near it, and are drifted ashore. Consequently it is well to examine the masses of driftweed driven ashore, especially after storms, in search of these inhabitants of the deeper waters." [4] As might be inferred from the quotations given above, authors of manuals and floras have included algae picked up with those found actually attached; indeed, not to have done so would have left out a considerable part of the species, among them some of the most interesting. Occasionally attention has been called to some plant, from its recorded distribution unlikely to occur in the region where it came ashore, and it has been noted only as a waif, but as a rule, the question of origin has not been raised. Recently more consideration has been given to possible long distance transportation; Sauvageau, preliminary to giving a list of the algae of the Bay of Biscay,[5] says "Le temps a toujours été très calme durant mon séjour en Espagne, et les algues déposées sur le rivage n'étaient pas apportées de loin, comme cela arrive souvent après une tempête."

Reinke [6] enumerates three species which he considers as transported from their homes to the western Baltic, and not native there. Rosenvinge [7] gives a list of 48 species coming ashore on the west coast of Jutland, with indications as to their probable origin. Schiller's

[1] Farlow, l. c., p. 21.

[2] Hervey, Sea Mosses, p. 14, 1881.

[3] Murray, An introduction to the study of seaweeds, p. 27, 1895.

[4] Setchell, Directions for collecting and preserving marine algae. Erythea, Vol. VII, p. 24, 1899.

[5] Sauvageau, Note preliminaire sur les algues marines du golfe de Gascogne. Journal de Botanique, Vol. XI, p. 3 (of reprint), 1897.

[6] Reinke, Ueber Gaste der Ostseeflora. Berichte der deutschen Botanische Gesellschaft, Vol. X, p. 2, 1892.

[7] Rosenvinge, Om fremmede Alger ilanddrevne paa Jyllands Vestkyst. Bot. Tidsskrift, Vol. XXVII, p. 83, 1905.

recent paper [1] is concerned chiefly with algae that have a definite and prolonged unattached existence, usually with change of form from that of the fixed state, to adapt the plant to the unattached state; the possibility of transportation to considerable distances is however also discussed. That unless this possibility is taken into account one may be led into serious errors, was shown me by a recent experience.

On October 8, 1913, I visited the ocean shore of Eastham, Massachusetts, near the Nauset lighthouse. From Chatham to Highland Light in Truro the shore stretches for about 25 miles in a nearly straight line; a rather steep beach of shifting sand, overlooked by sand dunes. No algae ever grow here, and as off shore the bottom is the same loose sand with more or less shifting bars a short distance out, the occurrence of algae below low water mark is improbable. All I had found on my many visits here had been scraps, more or less battered, the same as one might find floating anywhere in Massachusetts Bay or Nantucket Sound. But on this occasion as I looked from the dunes I saw plants of good size washing up and down in the waves, and on going down I found to my surprise that the beach was strewn with *Laminaria*, and that not *L. Agardhii* Kjell., the common species of southern New England, but *L. longicruris* De la Pyl., a northern species, occurring south of Nahant only at a few isolated stations. They were not battered and waterworn plants, but perfectly fresh, and were of all sizes from young plants 3–4 dm. high, to mature individuals, with stipe alone over three meters long. The small plants were often in clumps of a number of individuals, still attached at base to shells or pebbles; the laminae often bore abundant fruit. Along with the *Laminaria* were, almost equally abundant, but from their smaller stature less conspicuous, *Fucus vesiculosus* L., *Ascophyllum nodosum* (L.) Le Jolis, *Desmarestia aculeata* (L.) Lamour., and *Rhodymenia palmata* (L.) Grev. There had been a heavy surf for several days, and my first thought was that some colony in deeper water had been struck by it, but from what I knew of the bottom, I concluded that this would be very unlikely; moreover *Fucus* and *Ascophyllum* are litoral plants. They occur more or less all along the southern New England coast, but I know no station except Newport, Rhode Island, where the plants are at all luxuriant; usually they are much smaller than the northern form, or than the plants now in

[1] Schiller, Ueber Algentransport und Migrationsformationen im Meere. Internationale Revue der gesamten Hydrobiologie und Hydrographie, Vol. II, p. 62, 1909.

question. On the *Ascophyllum* were large tufts of *Polysiphonia fastigiata* (Roth) Grev., which occurs south of Cape Cod only rarely and in reduced form. The *Rhodymenia* fronds were large, often 3–4 dm. high and nearly as broad; and finally I found one fine tuft of *Halosaccion ramentaceum* (L.) J. Ag. and several plants of *Monostroma fuscum* (Post. & Rupr.) Wittr; the *Halosaccion* has not been recorded south of Marblehead, and a doubtful record of the *Monostroma* at Newport is the only one south of Boston. As epiphytes on the *Laminaria* I noted *Ceramium rubrum* (Huds.) Ag., *Chantransia* sp.?, *Pylaiella littoralis* (L.) Kjell., *Ectocarpus confervoides* (Roth) Le Jolis, *Antithamnion floccosum* (Muell.) Kleen and *Rhodochorton Rothii* (Eng. Bot.) Näg.[1]

All this taken together left no doubt in my mind that the northeast storm had brought the whole collection (there were thousands of Laminarias in sight) from the shores of northern New England. From the absence of other species of *Laminariaceae*, it is probable that they came from some quite limited station. I know of no point on the Massachusetts coast where *Laminaria longicruris* grows in large numbers, unmixed with other species of *Laminaria* or with *Alaria*, but on the Maine coast, east of Portland, there are stations where *L. longicruris* is abundant and unmixed with other *Laminariaceae*, usually in channels where there is a rather swift tidal current, but not exposed to the surf. If a gale happened to blow in a quarter that would send a heavy surf up such a channel, there might be torn up just such a "formation" or "facies" as I found, and the northeast wind might then carry it to the place where I found it. With the wind then prevailing it could hardly have originated west of Penobscot Bay, which would give 150 miles as the least distance it must have travelled. On returning to the beach the next day, I found the plants of the day before in a narrow windrow at high water mark, and rapidly decaying; the beach below and the water were bare and empty as usual.

Now if I had been on an unfamiliar shore, and was making a record of the plants of the region, I think that under the circumstances recorded, I should not have hesitated to enter in the list all the species I have named above; I have no doubt that some anomalies in regional

[1] It is noteworthy that among the 48 species recorded by Rosenvinge as coming ashore at Jutland, 44 were epiphytes on *Ascophyllum nodosum* and *Himanthalia lorea* (L.) Lyng. As long as the host plant is intact, the epiphytes find little change from their normal conditions, though most of them would speedily perish if detached from the host.

lists may be due to this cause; in this case it is only because the "consignment" came ashore at a point itself barren that the detection and correction is so easy; if it had been at a place where deep water plants from just off shore were also coming in, it might be quite perplexing. It may seem like severity to put all deep water plants on the waiting list until some dredging expedition vouches for their eligibility, but it may be the only safe way.

North Eastham, Massachusetts.

THE AMERICAN VARIATIONS OF POTENTILLA PALUSTRIS.

M. L. Fernald and Bayard Long.

(Plate 106).

In 1908 attention was called by Dr. Theodor Wolf,[1] in his *Monographie der Gattung Potentilla,* to the fact that in North America *Potentilla palustris* is not a uniform species but that the little known var. *villosa* (Pers.) Lehm., a plant of rare occurrence in northern Europe and possibly Greenland, is also found on the continent of North America (Cartwright, Manitoba). In 1909 our knowledge of var. *villosa* was sufficient to justify the statement that it is found "Throughout the St. Lawrence system from n. N. S. and e. Que. to L. Superior and L. Winnipeg,"[2] and in 1910 the plant was recorded as "the common form of the species in eastern Washington County, Maine."[3] In the study of this and other variants of *P. palustris* it has been necessary to look with some detail into the plant throughout its known range and into the very different treatments of its variations by authors, either as a *Potentilla* or as a separate genus, *Comarum.* As a result of these studies it seems to the writers that the plant in America falls into three well marked varieties with pronounced geographic ranges.

[1] Wolf. Mon. Pot. 76 (1908).
[2] Robinson & Fernald, Rhodora, xi. 48 (1909).
[3] Fernald & Wiegand, Rhodora, xii. 140 (1910).

As indicated by the *Species Plantarum* Linnaeus intended as his *Comarum palustre*[1] the common European plant. He gave no description but cited numerous previous works, *Flora Lapponica*, etc., the *Quinquefolium palustre rubrum* of Bauhin and the *Pentaphyllum palustre* of Cordus, and gave the habitat "*in* Europae *uliginosis*." Subsequent European students of the group, such as Lehmann and Wolf, have accepted as typical *Potentilla palustris* the common plant of Eurasia (fig. 1) and northern North America, with leaflets oblong-lanceolate, green and glabrous or merely puberulent above, glaucous and glabrous or merely puberulent beneath,[2] and have recognized a single notable variety, var. *villosa* (Pers.) Lehm., a plant figured by Plukenet and said to come from Sweden and Ireland.

In 1836, however, Rafinesque,[3] taking up the Linnean genus *Comarum* "(or Pancovia or Potentilla)" said: "I can increase it to 3 Species; all in my Autikon. Only one was known," and treated "*Comarum* (or Pancovia or Potentilla)" *palustre* as a strictly Old World plant, described "fol. pinnatis"; separated the "C. *palustre* of all the American botanists!" as "*Comarum* (Panc. Pot.) *digitatum*," "fol. . . . .digitatis"; and described as another new species "*Comarum* (Panc. Pot.) *angustifolium*," "fol. pinnatis, ... foliolis 5 cuneatis angustis" from "Oregon or N. W. Amer." In the *Autikon Botanikon*, in 1840, Rafinesque somewhat modified his treatment, coining the name *C. tomentosum* for Persoon's *C. palustre*, *β villosum;* altering the range of his *C. angustifolium* to read "Origon and Boreal America, Ohio: very peculiar, leaves narrow smooth, fl. small &c."; and publishing a new *C. angustifolium*, "*Var. parvifolium* Raf. folioles 5–7 small smooth cuneate or elliptic, petiols membranose, flowers very small, branches uniflore; Labrador, 3 to 10 inches high, folioles less than uncial."[4]

More recently, in the *North American Flora*, Rydberg[5] has stated that the typical form of the species, with "leaflets . . . .elliptic or oval," occurs in "Northern and subalpine Europe and Asia; also subarctic and arctic America, from Greenland and Labrador to Alaska," while

[1] L. Sp. Pl. 502 (1753).

[2] "Foliola. . .oblongo-lanceolata, acute-serrata, superiore facie laete-viridia, dorsa glaucescentia, venosa" — Lehm, Mon. Pot. 53 (1820); "foliola. . .oblongo-lanceolata acute et aequaliter serrata, supra viridia, subtus glauca, utrinque vel subtus tantum puberula" — Wolf, Mon. Pot. 75 (1908).

[3] Raf. Fl. Tell. pt. ii. 55, 56 (1836).

[4] Raf. Aut. Bot. 170 (1840).

[5] Rydb. N. A. Fl. xxii. 355 (1908).

"the more common American form (*C. angustifolium* Raf.)," with leaflets "linear-oblong," extends "south to New England, Minnesota, Wyoming, and California"; thus seeming to indicate that the common American plant has recognizably narrower leaflets than the European. In their study of this species, however, the writers have been unable to make out any definite difference in the shape of leaflets to separate from the European plant the common plant of southern British America and the Northern States, which extends southward at least to New Jersey, Pennsylvania, Ohio, Indiana, Illinois, Iowa, Wyoming and California. In the plant of Europe (fig. 1) the leaflets are, of course, variable in size and form, but they have in general an oblong-lanceolate to oblanceolate outline, and the various Eurasian specimens are readily matched by specimens from Canada and the northern United States. In the Eurasian plant the terminal leaflet of the primary leaves varies (in a rather small series of specimens examined) from 2–7 (average 4) cm. in length, though some of the European plates show that they may be longer. In a much larger American series the common plant has the terminal leaflet ranging in length from 2–10 (av. 5.2) cm. In the Eurasian plant the terminal leaflet ranges from 0.9–2.7 (av. 1.6) cm. wide, in the American from 0.7–3.8 (av. 1.8) cm. wide. Expressed as a proportion, the breadth of the terminal leaflet in the Eurasian plant is $\frac{3}{10}$–$\frac{1}{2}$ as great as the length; in the common American plant the terminal leaflet is $\frac{1}{6}$–$\frac{1}{2}$ as broad as long, but it should be noted that the plants with narrowest leaflets come for the most part from the West — Montana, Washington, Oregon, etc. and are undoubtedly the extreme which was separated by Rafinesque as *Comarum angustifolium* (fig. 2). Similar plants with the leaflets only $\frac{1}{6}$ as broad as long are found at scattered points eastward and the variant seems to be merely an extreme of the series rather than "the more common American form," for as already stated, the majority of American specimens seem to the writers quite inseparable from the Eurasian material.

The small-leaved plant of Labrador and Alaska (and the islands of northeastern Asia), however, which Rafinesque separated as *Comarum angustifolium*, var. *parvifolium* and which Rydberg identifies as the typical form of *Comarum palustre*, impresses us as sufficiently distinct for varietal recognition. The characters emphasized by Rafinesque, the small cuneate or elliptic leaflets and the few flowers ("branches uniflore"), seem to be reasonably constant in nearly all plants from

the coastal regions of Labrador and Alaska and the islands of Bering Sea (fig. 3), the elliptic to cuneate-obovate subtruncate or round-tipped leaflets being 1.3–4.5 (av. 2.75) cm. long and 0.9–2.5 (av. 1.5) cm. broad, ranging from $\frac{1}{2}$ –$\frac{2}{3}$ as broad as long.

The other noteworthy variety, *Potentilla palustris*, var. *villosa* has already been referred to. In this plant the petioles, stipules, peduncles, bractlets, etc. are densely glandular-villous and the leaflets are villous or very densely sericeous. The plant (fig. 4) was figured and described by Plukenet[1] in 1692 from Sweden and Ireland; was taken up by Linnaeus in his *Flora Lapponica* as an unnamed variety "rarius observatur & plane non differt a naturali planta";[2] was recognized without discussion by Persoon as *Comarum palustre, β villosum*;[3] and was later transferred by Lehmann[4] to *Potentilla*.

That *Potentilla palustris*, var. *villosa* is a rare plant in Europe is indicated by the citation of specimens by European monographers. Plukenet, upon whose figure and description the variety rests, said that the plant came from Sweden and Ireland;[5] but in his *Revisio Potentillarum* Lehmann omitted the Swedish citation and referred to the plant only "in Groenlandia et Hibernia";[6] while Wolf, in his monumental *Monographie der Gattung Potentilla*, states that it appears to be a subarctic plant which Lehmann knew only from Greenland and Ireland, though J. Lange says in his *Conspectus Florae groenlandicae* that he has not seen it from Greenland but from Iceland. Wolf goes on to say that in an old English herbarium he has seen the plant from "Canada, Distrikt Cartwrigt [Cartwright, Souris Co., Manitoba] (leg. W. Scott 1891)."[7] With the exception of the Cartwright record and the old but perhaps erroneous report from Greenland, there seems to have been no suggestion that the plant occurs in North America until the notes published in Rhodora in 1909 and 1910; but the range of the plant in North America, from the Magdalen Islands, Nova Scotia, and Maine to Minnesota and Manitoba, indicates that, with us at least, it belongs to the Canadian rather than the subarctic zone.

[1] Pluk. Phyt. t. ccxii. f. 2 (1692).

[2] L. Fl. Lapp. 172 (1737).

[3] Pers. Syn. ii. 58 (1807).

[4] Lehm. Stirp. Pug. ix. 44 (1851).

[5] "*Pentaphyllum palustre rubrum, crassis, & villosis foliis Suecicum, & Hibernicum. hujus exemplar ex Suevia sibi allatum. nobis dedit* Reverend D. Stonestreet, *quod etiam Ornatissimus Vir D. Gideon.* Bonavert *ex Hibernia (qua invenit) rediens, nobis amicissime communicavit.*"— Pluk. Phyt. t. ccxii. f. 2 (1692).

[6] Lehm. Revis. Pot. 74 (1856).

[7] Wolf, Mon. Pot. 76 (1908).

In his account of *Potentilla palustris*, var. *villosa*, Lehmann said "*β villosa*, minor";[1] but as Wolf points out Lehmann's diagnosis "ist ungenau und zweideutig" and the var. *villosa* instead of being called "minor" should be described "foliolis magnis."[2] That the leaflets are larger than in other variations of *P. palustris* is well shown by measurements of the 16 sheets of specimens examined. In these plants the leaflets are as shown in Plukenet's figure and as later described by Rafinesque (as *Comarum tomentosum*), presumably from Plukenet's drawing: "more robust....with broader leaves [leaflets] obl[ong-] ellipt[ic]";[3] and measurements of the terminal leaflets of this American series of var. *villosa* show them to vary from 3.3–9.4 (av. 5.6) cm. long and from 1.4–3.1 (av. 2.2) cm. broad, or from $\frac{1}{3}$–$\frac{3}{5}$ as broad as long, thus indicating that the leaflets are relatively considerably broader than in either the European or the American plants which are passing as typical *P. palustris*. In fact, so many of the specimens from eastern America have leaves of which Plukenet's figure might easily pass as a tracing that one is led to infer that Lehmann's lack of a clear understanding of the variety was indicated not merely by his description of it as "minor" but by his characterization of Plukenet's figure as "mala."[4] The occurrence of this variety, with glandular-villous peduncles and rather large elliptic-oblong villous leaflets, so generally in the comparatively temperate belt of southern Canada and the adjacent States together with Lehmann's vagueness in describing the plant and Lange's statement that he does not know of it in Greenland, indicate that the Greenland record (originating with Lehmann and apparently unverified by later students) may wisely be treated with doubt until more clearly vouched for.

Another variant of *Potentilla palustris*, somewhat conspicuous in its extreme development, is forma *subsericea* (Becker) Wolf,[5] originally proposed by Becker as a variety.[6] Our own experience accords with that recently described by Mr. S. F. Blake,[7] and it is probable that the form is an ecological state rather than a true geographic variety, for the sericeous foliage is most often found in exsiccated spots or as a late development in colonies which earlier in the season produced the ordinary green leaves. Since this form of *P. palustris* is sometimes

[1] Lehm, l. c.
[2] Wolf, l. c.
[3] Raf. Aut. Bot. 170 (1840).
[4] Lehm. Mon. Pot. 53 (1820).
[5] Wolf, Mon. Pot. 76 (1908).
[6] Becker, Deutsch. Bot. Monatschr. xv. 85 (1897).
[7] S. F. Blake, Rhodora, xv, 165 (1913).

mistaken for var. *villosa* it is probable that some of the unverified or doubtful records of the latter belong to forma *subsericea*.

Briefly summarized our interpretation of the American variations of *Potentilla palustris* follows.

Potentilla palustris (L.) Scop. Figs. 1 and 2. Branches more or less minutely pilose or glandular above, 1–many-flowered: leaflets oblong-lanceolate to oblanceolate, acutish to obtuse, green and glabrous or merely puberulent above, glaucous and puberulent or sericeous beneath: the terminal leaflets of the primary leaves $\frac{1}{6}$–$\frac{1}{2}$ as broad as long, 2–10 (av. 4.6) cm. long, 0.7–3.8 (av. 1.7) cm. wide.— Fl. Carn. ed. 2, i. 359 (1772). *P. Comarum* Nestler, Mon. Pot. 36 (1816). *P. rubra* Hall. f. in Ser. Mus. Helv. i. 56 (1818). *P. digitata* and *angustifolia* Raf. Fl. Tell. ii. 55, 56 (1837). *Comarum palustre* L. Sp. Pl. 502 (1753). *C. digitatum* and *angustifolium*, Raf. l. c. 55, 56 (1837). *Argentina rubra* Lam. Fl. Fr. iii. 120 (1778). *Pancovia palustris, digitata,* and *angustifolia* Raf. l. c. 55, 56 (1837).— Cooler regions of Eurasia; in North America known from Labrador, Ungava, Keewatin, Yukon, and Alaska, southward to Newfoundland, Nova Scotia, southern New England, northern New Jersey, eastern and northern Pennsylvania, Ohio, northern Indiana, northern Illinois, northern Iowa, Wyoming and California.— Forma subsericea (Becker) Wolf, Mon. Pot. 76 (1908); S. F. Blake Rhodora xv. 165 (1913). Var. *subsericea* Becker, Deutsch. Bot. Monatsschr. xv. 85 (1897); Fernald & Wiegand, Rhodora, xii. 111, 140 (1910). Leaflets densely sericeous upon both surfaces. Apparently a form developed in exsiccated habitats or toward the end of the summer.

Var. **parvifolia** (Raf.) n. comb. Fig. 3. Similar, but smaller: branches 1–4-flowered: leaflets elliptic to cuneate-obovate, subtruncate or rounded at tip; the terminal $\frac{1}{2}$–$\frac{2}{3}$ as broad as long, 1.3–4.5 (av. 2.7) cm. long, 0.9–2.5 (av. 1.5) cm. broad.— *Comarum angustifolium*, var. *parvifolium* Raf. Aut. Bot. 170 (1840).— Labrador, Alaska, and islands of Bering Sea; examined from the following stations. Labrador: Ramah, *A. Steeker*, no. 323; Okkak, *Fratres Moravi;* Nain, *Lundberg;* Hopedale (large-leaved transitional plant), *Sornborger*, no. 131; Rigoulette, *Bowdoin College Expedition*, no. 270; Spear Harbor, *C. W. Townsend*, no. 44. Alaska: Cape Nome, *F. E. Blaisdell;* Anvik, *J. W. Chapman*, no. 4; St. Paul Island, *J. M. Macoun*, no. 71; Dutch Harbor, Unalaska, *E. C. Van Dyke*, no. 93. Commander Islands: Bering Island, *Stejneger*, no. 27.

Var. villosa (Pers.) Lehm. Fig. 4. Often coarser: branches few–many-flowered, with the petioles, peduncles, bractlets, etc. densely glandular-villous: leaflets villous or densely sericeous, oblong-elliptic to narrowly obovate, rounded at tip, $\frac{1}{3}$–$\frac{3}{5}$ as broad as long; the terminal 3.3–9.4 (av. 5.6) cm. long, 1.4–3.1 (av. 2.2) cm. broad.— Stirp. Pug. ix. 44 (1851) and Revis. Pot. 74 (1856); Walp. Ann. ii. 483 (1851–52); Wolf, Mon. Pot. 76 (1908); Robinson & Fernald,

Rhodora, xi. 48 (1909); Fernald & Wiegand, Rhodora, xii. 140 (1910). *Pentaphyllum palustre rubrum, crassis, & villosis foliis* Pluk. Phyt. t. ccxii. f. 2 (1692). *Comarum palustre, β. villosum* Pers. Syn. ii. 58 (1807); Rydb. Mem. Dept. Bot. Columbia Univ. ii. 163 (1898) and N. A. Fl. xxii. 355 (1908). *C. tomentosum* Raf. Aut. Bot. 170 (1840).—Reported but apparently rare or of doubtful status in Sweden, Ireland, Iceland and Greenland (see notes above), and Germany and Hungary (records questioned by Wolf, Mon. Pot. 76). In North America definitely known from the following stations. Quebec: Alright Island, Magdalen Islands, *Fernald, Long & St. John*, no. 7619. Nova Scotia: near Pictou, *Howe & Lang*, no. 478. Maine: Princeton, *Fernald & Wiegand* (*Fernald*, no. 1920); Moose Island, Passamaquoddy Bay, *Fernald & Wiegand* (*Fernald*, no. 1921); Marshfield, *Kate Furbish;* Merchants' Island, Hancock Co., *N. T. Kidder;* Readfield, *Kate Furbish.* New York: Wellesley Island, Jefferson Co. (transitional form), *Robinson & Maxon*, no. 9; Chatauqua Co., *M. S. Pettit.* Minnesota: Lake Kilpatrick, Cass Co., *C. A. Ballard;* Fort Snelling, *E. A. Mearns.* Manitoba: Lake Winnipeg Valley, *Bourgeau;* Cartwright, *W. Scott* (acc. to Wolf). A specimen from Port Ludlow, Washington (*F. Binns*) strongly approaches var. *villosa* but is hardly typical.

Explanation of Plate 106.

Fig. 1. Typical leaf of *Potentilla palustris*, after Svensk Botanik, t. 310. Fig. 2. Leaf of extreme form of *P. palustris* with narrow leaflets (*Comarum angustifolium* Raf.) from Ione, Washington (*Kreager*, no. 427). Fig. 3. Leaf of var. *parvifolia* from Dutch Harbor, Unalaska (*Van Dyke*, no. 93). Fig. 4. Leaf of var. *villosa* from Princeton, Maine (*Fernald*, no. 1920.)

FLORA OF THE SANDY RIVER VALLEY IN MAINE.

Clarence H. Knowlton.

The Sandy River is a tributary of the Kennebec, in western Maine. It rises in the central part of Franklin County, with two main branches. One of these originates in a string of small ponds lying in Sandy River Plantation, and receives tributaries from Letter E and No. 6. The other branch rises in Redington, receiving many brooks from Mt. Saddleback in Madrid. The river is about fifty miles long, flowing southeast from its sources through Phillips, Avon, Strong and Farmington; then turning to the northeast it flows through New Sharon between Stark and Mercer, then through Stark into the Kennebec,

two or three miles below Madison. Some of the sources are at least 3500 feet above the sea. At its mouth it is only 190 feet above sea-level.

I have never visited the Sandy River Ponds, but I have explored several of the mountain brooks which are near the beginnings of the river. These are mostly noisy torrents and trout-brooks, full of huge rounded boulders and gravel, with only occasional specimens of *Conioselinum chinense, Sium cicutaefolium* and clumps of sedge (*Carex torta* and *C. lenticularis*), to differentiate their flora from that of the surrounding woods.

From Phillips to New Sharon, some thirty miles, the river is a graded stream, with numerous meanders, broad intervales, ox-bow cut-offs and splendid terraces. These terraces are of sand and gravel above Farmington, with more clay below. Farmington village lies in part on the remnant of an old sand-plain, formed as a delta at the head of a marine estuary in the Champlain epoch, although its altitude is now 440 feet.[1] Nearly half of this sand-plain has been carried away by the river. Most of this work was probably done by the swollen stream which flowed from under the retreating glacier in the last days of the glacial period, when the ice was fast disappearing from the valley. Erosion has undoubtedly quickened greatly during the last 125 years, since the intervales were cleared of the forest. Terraces of equal height are visible on both sides of the valley in many places, showing the original height of the glacial and post-glacial deposits. Their material is closely stratified.

In summer the river is low and has little erosive power. Its gravelly beaches are covered in many places by *Apocynum cannabinum* and *Prunus pumila*, the two most common species. *Salix cordata* and *S. lucida* form immense clumps on this gravel, their height from a few inches to several feet. In sandy places there are tufts of *Panicum tennessecnse*. Where the sediment is clayey it is easy to find *Ranunculus Flammula*, var. *reptans*, *Juncus nodosus* and *J. filiformis*. Clumps of *Carex torta* are occasional.

Perhaps the most characteristic habitat of this part of the valley is the alluvial thicket, which lines the shore in many places. The American elms are everywhere here, usually scattered, but very numerous. They are also the handsomest trees of the intervales,

[1] George H. Stone, The Glacial Gravels of Maine and their Associated Deposits, Monographs U. S. G. S. XXXIV, Plate II, page 484, etc. 1899.

adding a graceful beauty to the scenery. *Acer saccharinum* is abundant in the thickets, often reaching out over the river, and people call it the *river* maple. It bears the first flowers of spring, for that other harbinger of spring, the skunk cabbage, I have never found in the valley, although it flourishes along the Androscoggin, less than fifteen miles away. *Populus balsamifera* is frequent, and there are numerous willows — *Salix cordata, S. lucida, S. rostrata,* a little of *S. sericea* and near the villages, many staminate trees of *Salix alba,* var. *vitellina. Tilia americana* is not rare, and there are many other forest trees here and there, for when the first settlers came the intervales were mostly covered with hardwood forest.

On the edges of these thickets are such shrubs as *Alnus incana, Corylus rostrata, Cornus stolonifera,* and more rarely, at Farmington, *C. Amomum. Prunus virginiana* is exceedingly common, and almost always fruits heavily. The cherries are large, and in August as they ripen, are very handsome. I have never seen them so well developed anywhere else. Among the herbaceous plants in such places may be mentioned *Lilium canadense, Heracleum lanatum, Eupatorium urticaefolium, Helianthus decapetalus* in great abundance, *Aster macrophyllus* var. *ianthinus, A. paniculatus, A. umbellatus* and *A. punicens,* and much less frequent, *Conioselinum chinense* and *Angelica atropurpurea.*

There is also a wonderful growth of lianes, binding everything herbaceous and frutescent into almost impenetrable masses. *Vitis vulpina, Psedera vitacea, Clematis virginiana, Polygonum Convolvulus, Apios tuberosa* and *Convolvulus sepium* are the most vigorous of these. Near Farmington there are occasional strands of *Echinocystis lobata,* evidently escaped, and two vigorous thickets of *Celastrus scandens,* which I have seen only in one other place in the region — on Day Mt., at an altitude of 1000 feet or more.[1]

Inside these thickets, where the trees are taller, may be found *Laportea canadensis, Boehmeria cylindrica, Onoclea Struthiopteris* and *O. sensibilis, Elymus canadensis, Panicum clandestinum, Muhlenbergia foliosa, Bromus altissimus* and large quantities of *Veratrum viride.* Where the alluvial soil is of the finest sand, with but little humus, there are fine colonies of *Circaea intermedia,* a delicate but distinct shade plant which is well worth the finding. At Farmington I have found in these shady places *Carex cephaloidea* and *C. longirostris,* the

[1] Rhodora, VI, 208, 1904.

latter otherwise a complete stranger to the region. At Phillips I have found *Milium effusum* in woods like these, though I have elsewhere found it only in rich woods on mountain slopes.

The intervales have all been cleared, and are in grass-land or under cultivation. Their fertility is assured by occasional spring freshets, and the first farms settled were along the river. The cultivated fields bring forth the usual introduced weeds, but in the mowing-fields there are a few vigorous native species which compete successfully with herdsgrass and red-top. One of these is *Rhus Toxicodendron*, here a prostrate vine with yellowish-green foliage, which runs out from thickets and fence-rows everywhere, making the haying season a most dangerous time for the farmer who is not immune. This is the only form of poison ivy in the region. *Asclepias syriaca*, *Equisetum arvense* and *Vicia Cracca* are also very common in the grass. *Onoclea sensibilis* is everywhere, and is so vigorous that in a few years it will drive out the "English grass," even on the upland. After haying, when the first fronds have been cut, new fronds grow which are frequently to be classified as var. *obtusilobata*. This is the first plant to feel the frost, and on the morning afterward the air is everywhere fragrant from the chilled fronds. In spring the moister places are yellow with *Barbarea vulgaris*. Sandy places bring forth *Smilacina stellata*, and at Farmington there is one good station for *Pedicularis canadensis*, which shuns the firmer soil of the upland. I have never seen it north of this place.

The ox bows and cut-offs which the river has deserted are locally called "creeks." They are full of moisture-loving species, but so many of these plants are found in wet places all over New England, that I shall mention only a few of the more interesting. *Onoclea Struthiopteris* fringes many of these creeks, and is often five feet tall. *Glyceria* is very well represented, by *G. borealis* and four other species. *Zizania aquatica* is at two places in Farmington, so near the railway as to suggest its introduction from the outside world. *Carex retrorsa* is very common, and in one place I found this summer several plants of var. *Hartii*. This variety has smaller spikes than the type, with long drooping peduncles, and spreading perigynia. Prof. Fernald assures me that this plant is new to Maine, the nearest reported station being in western New Hampshire. At Strong there is a fine station for *C. Tuckermani*, and another for *Scirpus debilis*. *S. Torreyi* and *S. pedicellatus* are occasional, while *S. atrocinctus*, *S. rubrotinctus*,

S. georgianus and *S. cyperinus*, var. *pelius* are common. In *Sagittaria latifolia* there are all possible variations. In one place the leaves vary from wide to narrow with the depth of the water. *S. arifolia* also grows in these creeks. *Sparganium diversifolium*, var. *acaule* is rather common, as well as the much larger *S. americanum*. *Cicuta bulbifera* produces one umbel of flowers, but does not ripen seed, relying on a numerous crop of bulblets instead. *Lysimachia terrestris*, however, has both seeds and bulblets in abundance. One of the prettiest color schemes I saw last summer was a dry creek-bed filled with this plant and *Mimulus ringens*, both in flower. *Steironema ciliatum* is another handsome plant, when at its best.

The dry sandy banks of the river, and the similar terraces which arise from the intervales are paradises for *Solidago*. The handsomest kind is *S. squarrosa* which is everywhere abundant, a tall vigorous plant with a wand of large heads. *S. hispida* is a very common species in the region, while the closely related *S. bicolor* is infrequent. Other species are *S. juncea*, *S. nemoralis*, *S. serotina*, *S. canadensis*, *S. graminifolia* and a little of *S. puberula*. *Cuscuta Gronovii* is often parasitic on these goldenrods, especially near the river. *Apocynum androsaemifolium*, *Oenothera biennis* and various forms of *O. muricata*, with other coarse plants thrive in this loose water-washed till. *Apios tuberosa* and *Vitis vulpina* are also frequent in such places.

Wooded terraces have a soil full of humus, which is much richer. Here are found some of the forest trees, especially *Tilia americana*, *Acer saccharum*, *Populus grandidentata* and a very few trees of *Quercus rubra*. *Amelanchier laevis* is frequent where the terrace meets the intervale. In spring there are handsome beds of *Sanguinaria canadensis* here, with *Erythronium americanum*, *Dentaria diphylla* and *Viola scabriuscula*. A little later come *Smilacina racemosa*, *Pyrola asarifolia* (rare) and *Osmorrhiza Claytoni*. *Amphicarpa monoica*, *Desmodium canadense* and *D. acuminatum* represent the *Leguminosae*, but the two latter I have not found above Farmington. Interesting grasses are *Hystrix patula* and *Oryzopsis racemosa*. Summer and fall flowers include *Circaea Lutetiana*, *Solidago latifolia*, *Aster cordifolius*, *A. lateriflorus*, var. *hirsuticaulis*, *A. macrophyllus*, var. *ianthinus* and *Eupatorium urticaefolium*. Even in winter the stiff stems of *Equisetum hyemale*, var. *affine* may be seen sticking up through the snow.

One day the past summer I went ten miles downstream from Farmington to New Sharon, following the stream into Somerset county,

into the towns of Mercer and Stark. I expected to find a continuation of the flora above described, but it proved to be very different. The river flows through a plain laid down in the Champlain estuary. There is a big fall at New Sharon, below which the Sandy has cut a channel through 10 to 40 feet of alluvial overwash and estuarine clays to the ground moraine, and in a few places to the metamorphic bedrock. The Sandy River thus flows in a high-walled channel over boulders, with coarse, shingly beaches. It is here about as large as the Deerfield at Hoosac Tunnel, or the White River just above its mouth.

Along the shore are several species which I have never seen up-river. There is a good deal of a low non-fruiting *Equisetum* which seems to be *E. littorale*. It is frequent on the St. John and the Penobscot, but so far as I know, has not been reported on the Kennebec. *Cyperus strigosus* appears for the first time, in limited quantity, and there is everywhere a great deal of *Rynchospora glomerata*. *Carex vulpinoidea* I had not missed up-river till I found it here. Clumps of *Deschampsia caespitosa* are very numerous. *Stellaria longifolia*, *Cicuta maculata* and *Lycopus virginicus* are also new to the region. In Stark I found a fine colony of *Habenaria flava* flourishing in wet gravel. This has been found in Chesterville, about fifteen miles from here, by Miss Eaton,[1] but I do not know of any other station for it. In the drier places above the shingle *Andropogon furcatus* crowds out all other species where it grows, and it occupies large areas of light soil above the banks. Where there is light shade I found *Danthonia compressa* in some abundance. I have found one or two specimens only of this at Farmington. Another good find was *Hypericum punctatum*. Along a tributary brook under the alders the ground was densely carpeted with *Leersia virginica*, to the exclusion of other species.

The dry woods covering the terraces and fringing the few intervales were especially interesting. *Acer saccharinum* is infrequent and small, as it is not adapted for such dry soil. Its place is taken by *Tilia*, *Quercus rubra*, *Juglans cinerea*, *Populus tremuloides* and *Fraxinus pennsylvanica* in all sizes. *Prunus virginiana* is still abundant. Lianes were not vigorous, and much to my surprise, I found no traces of *Celastrus*. In an open place in sand I found *Triscum spicatum*, which I had found only at Phillips, 30 miles up stream, on ledges.

[1] L. O. Eaton, Rhodora V, 82–3, 1903 (As *H. virescens* Spreng.).

There were also clumps of *Agropyron caninum*. To me, however, the best find of the day was *Phryma Leptostachya* in Mercer, where it grew in dry alluvial woods with *Circaea Lutetiana*.

As this single day below New Sharon secured me fourteen species I had never collected in the region before, I feel confident that further exploration of the lower river will bring to light many other interesting plants.

Ranunculus septentrionalis is a frequent plant on many of the New England rivers, and I am considerably at a loss as to its scarcity along the Sandy. I have found it only once by the river at Farmington. It grows in one place on a tributary at least a mile from the river, and I found it in a clayey ditch at Stark, well back from the river. It seems to be very rare. *R. repens* I have found well introduced at Farmington and New Sharon.

In closing, I will mention the few genuine aquatics which I have found in the river. There are quiet reaches in its lower and middle course, and in such places *Isoëtes echinospora*, var. *Braunii* is common. *Nymphaea microphylla* is occasional, and there are several species of *Potamogeton*. Of these I have identified *P. amplifolius*, *P. dimorphus*, *P. bupleuroides* and *P. epihydrus*. The water in the creeks is stagnant, and often dries up completely, so they do not furnish a desirable habitat for aquatic plants.

For the convenience of any who are interested in the region, I add the following list of RHODORA articles about Franklin County plants.

EATON, LILLIAN O.: Orchids of Chesterville, V, 82, 1903; Plants of Chesterville, IX, 207, 1907; Plants of Chesterville, XI, 30, 1909.

JEWELL, H. W.: Notes on Some Ferns of Franklin County, IV, 247, 1902.

KNOWLTON, C. H.: On the Flora of Mt. Abraham Township, I, 191, 1899; On the Flora of Chesterville, II, 123, 1900; Flora of Mt. Saddleback, V, 35, 1903; On the Flora of Day Mt., VI, 206, 1904.

HINGHAM, MASSACHUSETTS.

ORONTIUM IN BARNSTABLE COUNTY, MASSACHUSETTS.

John Murdoch, Jr.

Mention was made at the June meeting of the New England Botanical Club by Mr. F. S. Collins of a specimen of *Orontium aquaticum* which he had collected for the club herbarium in Provincetown. This reminded the writer of an earlier collection of his own in the same town, and led him to look up the records of the species on Cape Cod. There are in the club herbarium specimens of E. and C. E. Faxon, from Truro, August 13, 1890, and of Charles A. Davis, from Provincetown, September 28, 1912. In the Gray Herbarium is a duplicate of the Faxon specimen, and no others from Barnstable County. The only other specimen from southeastern Massachusetts is one of C. H. Morss, from Middleboro. On a Decoration Day trip to Provincetown in 1904, the writer collected flowering specimens. In June, 1913, he collected fruiting material, and in August, 1913, made further observations, in the same region. *Orontium* thus seems to be rather an uncommon plant in this section, and a few notes on its habits might not be out of place.

Practically the whole of Provincetown consists of sand dunes. For a mile or more back of the village there is a low forest growth made up largely of pitch pine and oaks. The hollows among these wooded dunes are occupied by shallow ponds, some of which dry out completely during the summer. In four out of the six or seven seen by the writer, *Orontium* is very abundant. Up to the middle of June, it is the only conspicuous aquatic in these ponds. Later in the season water lilies and rushes also appear in considerable quantities. At blossoming time, in the latter part of May, the yellow spadices stand up plainly above the water, well warranting the common name of Golden Club, and the leaves are also well developed. By the middle of June, the fruit is ripe. The spadices have now bent over, leaving only occasionally an arch above the surface. The leaves, contrary to the description in the Manual, stand erect like those of the Pickerel Weed. Indeed, I have at a distance mistaken both *Orontium* for *Pontederia*, and the reverse. At the end of August, the fruit has practically disappeared. In the dry ponds, the leaves stand stiffly over the mud, while the roots are buried deep in the sand beneath.

It is a curious fact that in the ponds where the Golden Club occurred, no Pickerel Weed could be found, while in all the others it was abundant.

In one small pond between North Truro and Truro, I saw from the train a few plants of *Orontium*, but it occurs in none of the ponds which I have visited in Orleans and the eastern part of Brewster. There must be other stations for this plant on the Cape. Possibly the superficial resemblance of the leaf to that of *Pontederia* has led to its being overlooked. Future collectors in this region should examine localities like those in Provincetown — shallow ponds, with a layer of muck covering the sandy bottoms.

Newtonville, Massachusetts.

Scirpus occidentalis and Aster ptarmicoides in Connecticut. — In early September, 1912, I accompanied Dr. Charles C. Godfrey on a collecting trip in northwestern Connecticut, where we expected to see some of the rare or local species made known by the records of several preceding resident or transient botanists. In this our hopes were amply realized. But it is the purpose now to record two species not before recognized in the state.

During a brief interval between torrential rains which beset us during several days, we examined a bit of shore at Beardsley's Pond, in Sharon, and there found *Scirpus occidentalis* (Wats.) Chase in full fruit. High water made collecting difficult but we succeeded in hooking off a small supply of tops.

In the present year, on July 5, we again stopped at the Pond, finding the plants plentiful and apparently destined to fruit freely. The same morning and on the day preceding we had seen an abundance of the same species growing in shallow water at Twin Lakes, in Salisbury — acres of it. Here, after much search, we found a few panicles bearing some immature but characteristic fruit while the great mass of it was, and remained, unfertilized, presenting a peculiar appearance. Dr. Godfrey found very little fruit during August and early September.

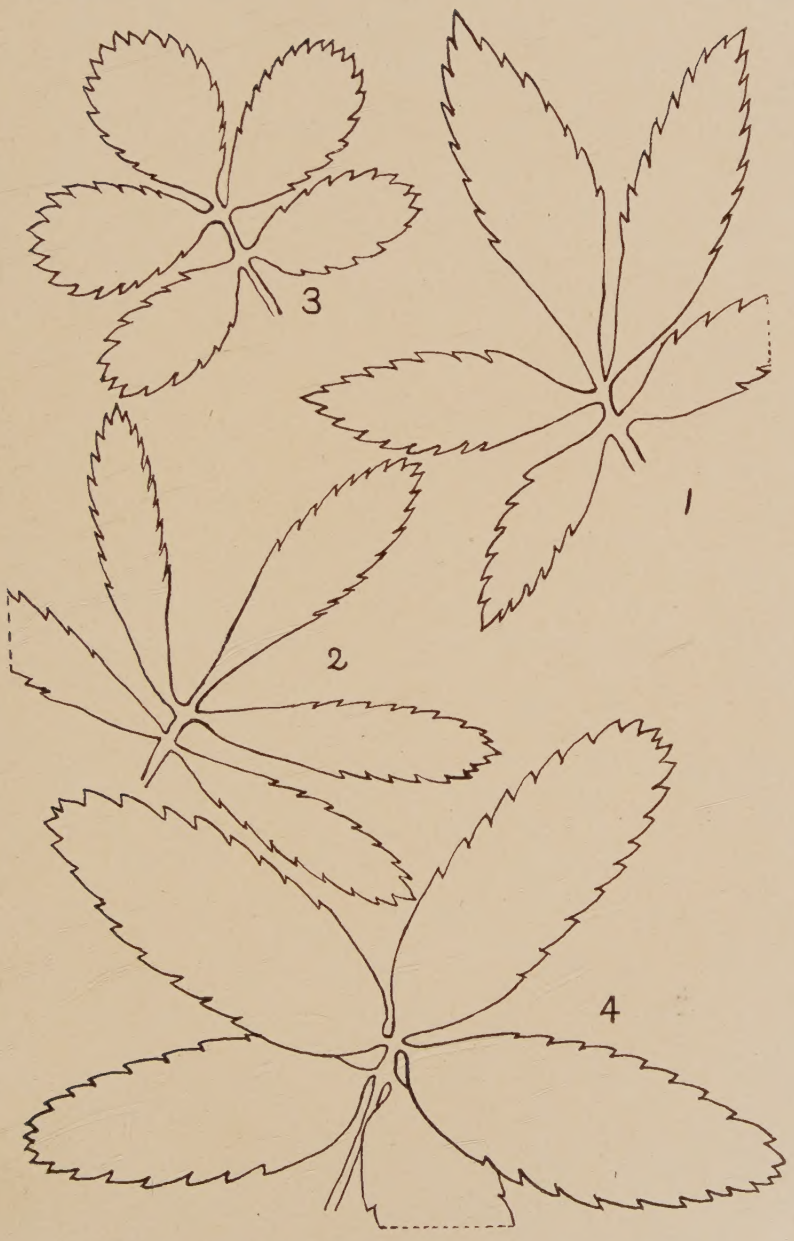
The water of Twin Lakes is strongly impregnated with lime which may have been an important reason for lack of fertility although the plants appeared to be of normal luxuriance, at least, if an average of 5–6 ft. out of water coupled with a submergence of 1–2.5 ft. represents thrift.

While these two stations are but few miles apart the strains appear to differ slightly. All, however, agree in their resemblance to most western material in their tendency to short rays and spikelets, the latter sometimes congested, and in the very slightly viscid scales. Our no. 5889 from Bay of Islands, Newfoundland (1908) is of similar characteristics, all thereby differing materially from most northeastern specimens. Furthermore, fruiting spikelets rarely exceeded 1 cm. in length and were occasionally only half that, or shorter with 3-4 achenes. It should be mentioned that *S. validus* or other ally of similar habit was not observed in either station.

The occurrence of *S. occidentalis* also in eastern Massachusetts would indicate its presence elsewhere in Connecticut, at least in northern districts.

This particular area of Connecticut consists largely of limestone, much of which is exposed. In the southwest drainage basin of two such hills, Tom and Miles Mountains, in Salisbury, we found in 1912 a few nicely flowering specimens of *Aster ptarmicoides* T. & G.— plainly out of place in the edge of a swamp. This year we found the species plentiful on the hills themselves, particularly the first mentioned, growing in dry soil on the slopes, ledges and about the edge of the cliffs. So far as we have learned its southernmost record in New England has been long known as S. Hadley, Massachusetts.— Edwin H. Eames, Bridgeport, Connecticut.

Vol. 15, no. 180, including pages 205 to 226 and title page of volume, was issued 13 December, 1913.



Leaves of Potentilla palustris and Varieties.

1, 2.

3. var pinnatifida

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